

ICESat (GLAS) Science Processing Software Document Series

Volume # GSAS Version Description Version 2.0

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Foreword

This document contains the GLAS Science Algorithm Software (GSAS) Version Description document. This document is developed under the structure of the NASA STD-2100-91, a NASA standard defining a four-volume set of documents to cover an entire software life cycle. Under this standard a section of any volume may, if necessary, be rolled out to its own separate document. This document is a roll-out of the user guide within the Product Specification Volume.

The GEOSCIENCE LASER ALTIMETER SYSTEM (GLAS) is a part of the EOS program. This laser altimetry mission will be carried on the spacecraft designated EOS ICESat (Ice, Cloud and Land Elevation Satellite). The GLAS laser is a frequency-doubled, cavity-pumped, solid state Nd:YAG laser.

This document was prepared by the Observational Science Branch at NASA GSFC/WFF, Wallops Island, VA, in support of B. E. Schutz, GLAS Science Team Leader for the GLAS Investigation. This work was performed under the direction of David W. Hancock, III, who may be contacted at (757) 824-1238, hancock@osb.wff.nasa.gov (e-mail), or (757) 824-1036 (FAX).

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Section 1

Introduction

1.1 Identification of Document

This is the Version Description document for the Version 2 delivery of the GLAS Science Algorithm Software (GSAS). The unique document identification number within the GLAS Ground Data System numbering scheme is TBD. Successive editions of this document will be uniquely identified by the cover and page date marks.

1.2 Scope of Document

The GLAS I-SIPS Data Processing System, shown in Figure 1-1, provides data processing and mission support for the Geoscience Laser Altimeter System (GLAS). I-SIPS is composed of two major software components - the GLAS Science Algorithm Software (GSAS) and the Scheduling and Data Management System (SDMS). GSAS processes raw satellite data and creates EOS Level 1A/B and 2 data products. SDMS provides for scheduling of processing and the ingest, staging, archiving and cataloging of associated data files. This document is the Version Description for the GSAS Version 2 delivery.

1.3 Purpose and Objectives of Document

The purpose of this document is to provide a precise description of Version 2 of GSAS.

1.4 Document Organization

This document's outline is assembled in a form similar to those presented in the NASA Software Engineering Program [Information Document 2.3a].

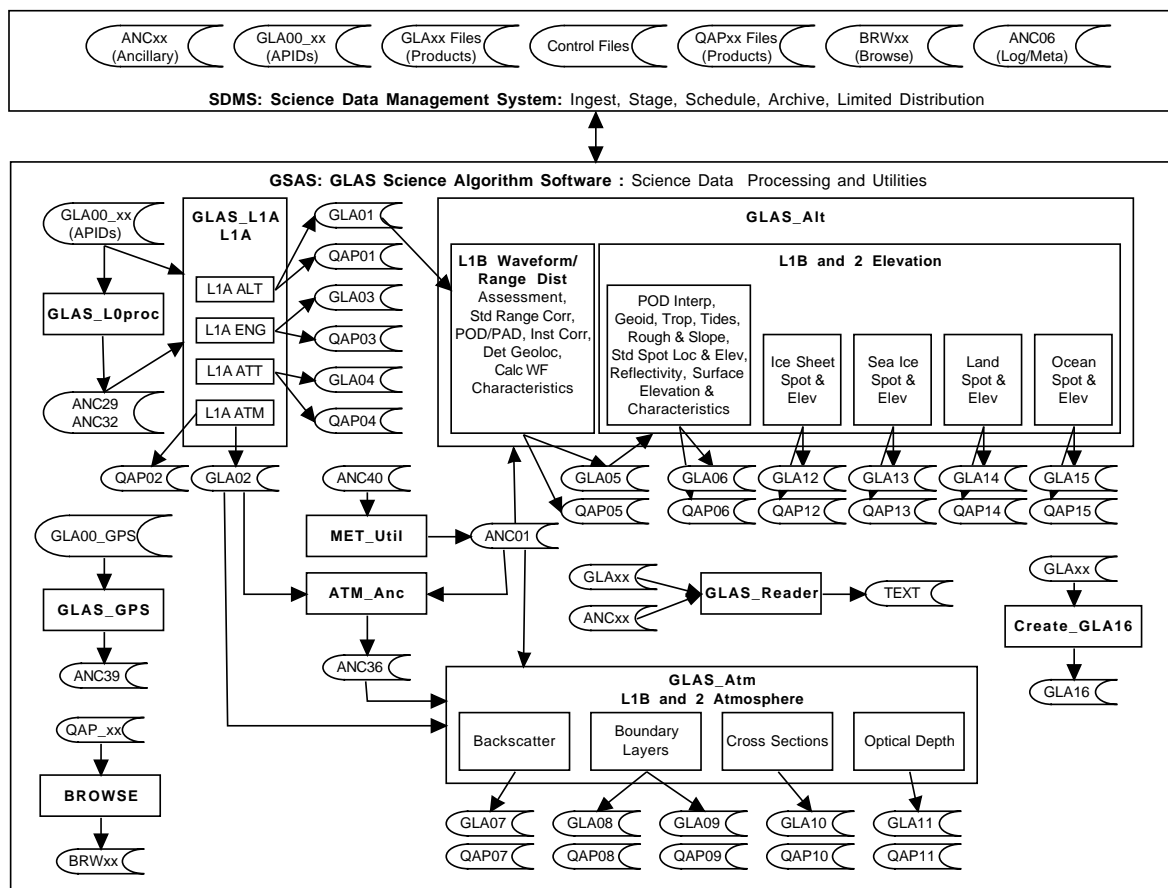


Figure 1-1 I-SIPS Software Top-Level Decomposition

1.5 Document Change History

Document Name: GLAS Science Algorithm Software Version Description		
Version Number	Date	Nature of Change
Version 0	July 1999	Original Version.
Version 1	November 2000	Revised for V1 software.
Version 2	November 2001	Revised for V2 software.

Related Documentation

2.1 Parent Documents

Parent documents are those external, higher-level documents that contribute information to the scope and content of this document. The following GLAS documents are parent to this document.

- a) *GLAS Science Software Management Plan* (GLAS SSMP), Version 3.0, August 1998, NASA Goddard Space Flight Center, NASA/TM-1999-208641/VER3/VOL1.

The GLAS SSMP is the top-level Volume 1 (Management Plan Volume) document of the four volumes of NASA software engineering documentation [Applicable Reference 2.2c]. It dictates the creation and maintenance of the Product Specification Volume (Volume 2). This document is a roll out of the Product Specification Volume.

2.2 Applicable Documents

- a) NASA Software Documentation Standard Software Engineering Program, NASA, July 29, 1991, NASA-STD-2100-91.
- b) GLAS Science Algorithm Software Detailed Design Document, Version 2.0, November 2001, NASA Goddard Space Flight Center.
- c) GLAS Science Algorithm Software User's Guide, Version 2.0, November 2001, NASA Goddard Space Flight Center.
- d) GLAS ISIPS Operational Procedures Manual, TBD.

2.3 Information Documents

- a) GLAS Science Telemetry Packets Definition Document, Revision B, October 11, 2000, NASA Goddard Space Flight Center, GLAS-582-SPEC-002.
- b) GLAS Standard Data Products Specification - Level 1, Version 4.0, November 2001, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-DPS-2621.
- c) GLAS Standard Data Products Specification - Level 2, Version 4.0, November 2001, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-DPS-2641.
- d) GLAS Science Data Management Plan (GLAS SDMP), Version 4.0, June 1999, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-DMP-1200.
- e) Derivation of Range and Range Distributions From Laser Pulse Waveform Analysis for Surface Elevations, Roughness, Slope, and Vegetation Heights, Version 3.0, July 2000, NASA Goddard Space Flight Center, et al.

- f) Precision Orbit Determination (POD), Version 2.1, February 2001, University of Texas Center for Space Research.
- g) Precision Attitude Determination (PAD), Version 2.1, February 2001, University of Texas Center for Space Research.
- h) Atmospheric Delay Correction to GLAS Laser Altimeter Range, Version 2.0, February 1999, NASA Goddard Space Flight Center, et al.
- i) Ocean Tidal Loading Corrections, Version 1.0, February 1999, NASA Goddard Space Flight Center, et al
- j) Laser Footprint Location (Geolocation) and Surface Profiles, Version 2.0, February 1999, NASA Goddard Space Flight Center, et al
- k) Atmospheric Data Products, Version 2.0, February 1999, NASA Goddard Space Flight Center, et al
- l) The Algorithm Theoretical Basis Document for Level 1A Processing, Version 0.2DRAFT, April 2001, NASA Goddard Space Flight Center/Wallops Flight Facility.

Section 3

Product Description

3.1 Purpose

GSAS generates the GLAS Standard Data Products and associated metadata describing the products and their quality. The software uses GLAS telemetry and ancillary data to produce the products using algorithms defined by the GLAS Science Team.

GSAS is delivered as a set of libraries and executables (PGEs). The design and structure of GSAS is fully described in the GSAS Detailed Design Document.

Throughout this document, files are referenced as one of two types: GLA or ANC. GLA files are integer-binary format product files containing Level 0-2 GLAS science data. The GLA files are fixed-length binary files containing scientific measurements. GLA files are both input and output to GSAS. ANC files are multi-format ancillary files supplied by the science team which are required for processing. These files are detailed in the GLAS Data Management Plan and GLAS Standard Data Product Specifications Documents.

3.2 Environment

GSAS software is developed for and delivered on the UNIX platform. This document assumes that the reader is familiar with UNIX operating system conventions. The software is currently supported only on the HP/UX 11.0 operating system with Fortran 90 version v2.3.

3.3 Functions

The GSAS functions for V2 are:

- Read GLAS telemetry data and standard data products and ancillary files. Provide time-synchronization between product and ancillary files and between multiple products.
- Create all standard data products in an integer-binary format. These data products are grouped into the following categories:
 - Level-1A products. (GLA01-02)
 - Waveform products. (GLA05)
 - Atmosphere products. (GLA07-11)
 - Elevation products. (GLA06, GLA12-15)
- Perform selective processing based on input and output defined in a user-supplied control file.
- Maintain a full processing history.

- Report errors and messages in a standardized fashion with user-defined options available.
- Read changeable parameters from Science Team-supplied ancillary files.
- Convert product data into human-readable output.
- Create sample (but not scientifically accurate) test products.

3.4 Restrictions and Limitations

The V2 delivery of the GSAS has the following limitations:

- The software has the capability of processing many different scenarios. However, only tested scenarios are supported. These scenarios are:
 - One processing string to create all L1A products (GLA00 to GLA01-02).
 - One processing string that starts with an L1A altimetry product (GLA01) input to produce a waveform product (GLA05).
 - One processing string that starts with a waveform product (GLA05) input to produce all elevation products (GLA06, 12,13,14,15).
 - One processing string that starts with L1A atmosphere (GLA02) input and produces L2 atmosphere products (GLA07,08,09,10,11).
- GLA03, and the associated processing software, while referenced in documentation, is not present in the V2 delivery.
- GLA04, and the associated processing software, while referenced in documentation, is not present in the V2 delivery.
- GLA10 and GLA11, and the associated processing software, while referenced in documentation, is not present in the V2 delivery.
- GLA16, and the associated processing software, while referenced in documentation, is not present in the V2 delivery.
- Not all utility PGEs conform the GSAS standards regarding control files, file naming, error reporting, and processing history.
- GSAS core and utility PGEs may be run without error if all ANC07 files specified within the control file. Only specific ANC07 files are required for each PGE, but we have verified that specifying all does not cause an error. This capability was verified in order to avoid a potential SMDM limitation.
- GSAS will **not overwrite** existing files. The software will halt with a fatal error unless old output files are removed before execution.
- Header support is preliminary. Only selected fields of the defined headers are filled.
- EOS metadata generation is not included in the V2 delivery.

- No process sanity checking is delivered in this version. This will be added in a later delivery.
- The GSAS is supported on HP/UX 11.0 with HP Fortran 90 compiler version 2.3.
- In a production environment, the GSAS would be controlled by the SDMS. The SDMS would produce control files, stage data, and control execution of the GSAS binaries. This document, however, is limited to GSAS and thus will not describe procedures within the scope of SDMS.

Section 4

Inventory and Product

4.1 Materials Released

Materials released include software code, documentation, static ancillary data and test data. These materials are delivered on physical media. Due to the size of ancillary and test data, a DLT tape shall be used as the distribution media. The documentation is delivered in form of Adobe PDF (Portable Document Format) files and, by request, hardcopy.

4.2 Product Content

To extract the GSAS Version 2 software, change to an appropriate directory (suggested at least 10GB available on the disk) and use the tar command to extract the software from distribution media.

When the tape is un-tarred, a `gsas_v2` directory and several sub-directories will be created. Table 4-1 lists the top-level directories. describes the top-level directories.

Table 4-1 Top-level Content

Item	Description
bin	Directory where executables are stored.
cc_util	Make utilities.
data	Science-team provided static-ancillary files and sample control files.
docs	Documentation in PDF format.
lib	Directory where shared libraries are stored.
Makefile	Distribution Makefile.
src	Source code.
test	Sample products and testing area.

The `bin` and `lib` directories are delivered without content. They will be populated during the installation process. The remainder of this subsection describes content of the other directories.

4.2.1 Makefile utilities (`cc_util`)

This directory contains GSAS-standard makefile utilities. These files are used in GSAS makefiles and can be modified to change such things as compile-time options in a consistent manner.

Table 4-2 cc_util Content

Item	Description
cc_make_final.sh	Clearcase glue script to ease installation.
make_defs.	Symbolic link to make_defs.hp
make_defs.hp	HP-specific Makefile definitions.
make_defs.incl	Generic Makefile definitions.
make_depends.incl	Makefile dependencies.

4.2.2 Ancillary Data (data)

Initial versions of the science-team supplied ancillary data files as well as sample control files are included in this release. These files are located in the data directory of the tarfile and are designated Version 1.0.

Table 4-3 data Content

Item	Version	Description
anc07_001_00_00.dat	2.0	Error and Status file. Generated by development team.
anc07_001_00_01.dat	2.0	Global constants file. Generated by development team.
anc07_001_00_02.dat	2.0	Atmosphere constants file. Generated by development team.
anc07_001_00_03.dat	2.0	Elevation constants file. Generated by development team.
anc07_001_00_04.dat	2.0	Waveform constants file. Generated by development team.
anc07_001_00_05.dat	2.0	L1A constants file. Generated by development team.
anc07_001_00_06.dat	2.0	Utility constants file. Generated by development team.
anc12_001_00_00.dat	n/a	DEM header. Generated by development team from anc12_001_00_01.dat.
anc12_001_00_01.dat	n/a	DEM. From GTOPO30 (U.S. Geological Survey's EROS Data Center)
anc13_001_00_00.dat	n/a	Geoid. EGM96.
anc16_001_00_00.dat	n/a	Load Tide Model file. This was provided by the science team. SPOTL (Duncan Agnew -- SCRIPPS)
anc17_001_00_00.dat	n/a	Ocean Tide Model file. This was provided by the science team. GOT99.2 (Richard Ray -- GSFC)

Table 4-3 data Content (Continued)

Item	Version	Description
anc18_001_00_00.dat	n/a	Standard Atmosphere file. Standard Atmosphere profile file, in house. Pressure and temperature based on LOWTRAN radiative transfer program. Humidity based on Anderson, G. P., S. A. Clough, F. X. Kneizys, J. H. Chetwynd, and E. P. Shuttle, 1986: AFGL atmospheric constituent profiles (0-120 km), AFGL-TR-86-0110, 43 pp. [NTIS ADA175173]
anc30_001_00_00.dat	n/a	Global aerosol categorization map file. This was provided by the science team.
anc31_001_00_00.dat	n/a	Aerosol tropospheric classification map file. This was provided by the science team.

4.2.3 Documentation (docs)

The required delivery documentation for Version 2 is found in the docs directory. These documents are listed in Table 4-4

Table 4-4 docs Content

Item	Version	Description
atbd_waveform.pdf	3.0	ATBD - Derivation of Range and Range Distributions From Laser Pulse Waveform Analysis for Surface Elevations, Roughness, Slope, and Vegetation Heights
atbd_pod.pdf	2.1	ATBD - Precision Orbit Determination (POD)
atbd_pad.pdf	2.1	ATBD - Precision Attitude Determination (PAD)
atbd_tropo.pdf	1.0	ATBD - Atmospheric Delay Correction to GLAS Laser Altimeter Ranges
atbd_tide.pdf	1.0	ATBD - Ocean Tidal Loading Corrections
atbd_geolocation.pdf	2.0	ATBD - Laser Footprint Location (Geolocation) and Surface Profiles
atbd_atmos.pdf	2.0	ATBD - Atmospheric Data Products
atbd_l1a.pdf	0.2D	ATBD - Level 1A Processing
gsas_accept_test_v2.pdf	2.0	GSAS Acceptance Test Plan, Version 2.
gsas_ddesign_v2.pdf	2.0	GSAS Detailed Design Document, Version 2.
gsas_user_guide_v2.pdf	2.0	GSAS User's Guide, Version 2.
gsas_ver_desc_v2.pdf	2.0	GSAS Version Description, Version 2 (this document).
glas_prod_spec_1_v2.pdf	4.0	GLAS Standard Data Product Spec - Level 1
glas_prod_spec_2_v2.pdf	4.0	GLAS Standard Data Product Spec - Level 2

Table 4-4 docs Content

Item	Version	Description
glas_smp_v2.pdf	3.0	GLAS Science Software Management Plan
glas_dmp_v2.pdf	4.0	GLAS Data Management Plan
udf.tar	2.0	Tarfile snapshot of the Unit Development Folders.

4.2.4 Source (src)

Contents of the src directory are described in detail within the GSAS Detailed Design Document. Table 4-5 lists each major subdirectory and it's corresponding executable/library version number.

Table 4-5 src Content

Item	Version	Description
atm_lib	v2.0	Links atmosphere code into library structure.
atmosphere	v2.0	Development code for atmosphere code.
elev_lib	v2.0	Links elevation code into library structure.
elevations	v2.0	Development code for elevations code.
GLAS_L0proc	v2.0	GLAS L0 PGE
GLAS_L1A	v2.0	GLAS L1A PGE
GLAS_Atm	v2.0	GLAS Atmosphere PGE
GLAS_Alt	v2.0	GLAS Altimetry PGE
met_util	v2.0	Met file Utility
atm_anc	v2.0	Atmosphere Utility
createGran_util	v2.0	Granule Utility
refOrbit_util	v2.0	Reference Orbit Utility
GLAS_Reader	v2.0	GLAS Reader Utility
lib	v2.0	Development shared library directory. (initially empty)
l1a	v2.0	<unused>
l1a_lib	v2.0	Development directory for L1A code
Makefile	v2.0	Master source Makefile
modules	v2.0	Development module directory. (initially empty.)
waveforms	v2.0	Development directory for waveforms code
wf_lib	v2.0	Links Waveforms code into library structure.
common_libs/anc_lib	v2.0	Development directory for anc_lib.

Table 4-5 src Content (Continued)

Item	Version	Description
common_libs/cntrl_lib	v2.0	Development directory for cntrl_lib.
common_libs/err_lib	v2.0	Development directory for err_lib.
common_libs/file_libt	v2.0	Development directory for file_libt.
common_libs/geo_libt	v2.0	Development directory for geo_libt.
common_libs/math_lib	v2.0	Development directory for math_lib.
common_libs/platform_lib	v2.0	Development directory for platform_lib.
common_libs/prod_lib	v2.0	Development directory for prod_lib.
common_libs/time_lib	v2.0	Development directory for time_lib.

4.2.5 Testing and Sample Products (test)

There are actually two distribution versions of GSAS 2.0. The deliveries are identical except for the content of the test directory. The internal delivery version contains test data and facilities as documented in the GSAS Acceptance Test Procedures. However, due to disk space and processing time requirements, external deliveries will have but a subset of the acceptance data and facilities. The content and usage of the test directory for external deliveries is documented in the GSAS Users Guide.

Section 5

Change Status

The Version 2 (V2) delivery of GSAS contains major changes from Version 1 (V1). The most important changes are changes to reflect V2 ATBDs and the adoption of a multi-PGE design approach.

5.1 Installed Changes

5.1.1 Science Algorithms

Implemented changes defined in Version 2 of the science algorithm ATBDs. These changes are documented in each respective ATBD. The latest ATBDs are available at:

<http://www.csr.utexas.edu/glas/atbd.html>

and

<http://glas.wff.nasa.gov/docs> (L1A).

The versions implemented in the V2 delivery are included as PDF files in the 'docs' directory of this distribution. The following table lists the version of each ATBD used for V2 development.

Table 5-1 ATBD Versions Implemented in V2

Title	Version
Derivation of Range and Range Distributions From Laser Pulse Waveform Analysis for Surface Elevations, Roughness, Slope, and Vegetation Heights	Version 3.0
Precision Orbit Determination (POD)	Version 2.1
Precision Attitude Determination (PAD)	Version 2.1
Atmospheric Delay Correction to GLAS Laser Altimeter Ranges	Version 1.0
Ocean Tidal Loading Corrections	Version 1.0
Laser Footprint Location (Geolocation) and Surface Profiles	Version 2.0
Atmospheric Data Products	Version 2.0
The Algorithm Theoretical Basis Document for Level 1A Processing	Version 0.2 DRAFT

5.1.2 Data Products

Version 2 of the data products were implemented as described in the GLAS Standard Data Product Specifications - Level 1 and 2 and the respective ATBDs. This includes requisite support for nearest-integer rounding and invalid values. Flags are now packed and unpacked in support routines. The entire product conversion process is documented in the GSAS Detailed Design.

Additionally, preliminary support for product headers is included.

The content and description of the as-implemented Level 1 and 2 products is available at :

http://glas.wff.nasa.gov/v2_products

The content and description of the as-implemented Level 0 APID data is available at :

http://instra2.gsfc.nasa.gov/glas_doc/glas-582-spec-002b.pdf.

5.1.3 ANC Files

Several additional ancillary files and the requisite support software have been added.

5.1.4 Multiple PGE Approach

GLAS_Exec was split into multiple PGEs. These include GLAS_L1A, GLAS_Atm, and GLAS_Alt.

5.1.5 GLAS_L0proc

GLAS_L0proc was added to the delivery. This software reads GLA00 APIDs and creates ANC29 index files for time alignment purposes.

5.1.6 GLAS_Reader

GLAS_Reader was written as a model PGE to replace the prod_readers. The prod_writers still exist as a development tool but are not part of this delivery.

5.1.7 Utilities

Several Utilities were added to the delivery (atm_anc, met_util, refOrbit_util, and createGran_util).

5.1.8 Version Modules

Version module numbers have been updated to reflect a consistent v2.0 in order to prepare for a more aggressive phased delivery approach.

5.2 Waivers

- Not all scenarios specified in the Requirements document are tested.
- GLA03 support is not delivered.
- GLA04 support is not delivered.
- GLA10 and GLA11 support is not delivered.
- GLA16 support is not delivered.
- Several PR/CRs have been suspended for a later version.

5.3 Possible Problems and Known Errors

The software development team uses Change Requests (CR) and Problem Reports (PR) to identify problems in the software. Table 5-2 lists the PRs and CRs open for V2. These will be corrected in a later delivery.

Table 5-2 Open or Suspended PR/CRs in Version 2

PR/CR	Short Description
PR20011019-001	altimeter frame flag is not being set correctly in V2 for GLA05.
IPR20011018-005	GLA05 lat/lons bad where part of frame is filled waveforms.
PR20011018-004	L1A Atmosphere QA needs some changes.
PR20011016-001	QAP05 files with 0-value start & end times
PR20011009-003	units on DEM on GLA12 incorrect
IPR20010907-001	L_Alt needs to initialize temporary variables
CR20010831-003	Re-Add Spacecraft Elevation to GLA01
CR20010830-001	compression type is wrong rate on gla01 and compression variable confusion
CR20010809-001	QA output interval entry mechanism
PR20011018-003	no headers on GLA05 when running just 20 sec of data
IPR20011018-002	WFMgr may not handle end of processing correctly.
PR20011005-001	gla02_scal_mod needs to be fixed for V2+
CR20010208-003	Change Calculation of Reflectance and Add a Variable to GLA01
CR20000524-002	Control file input modification request and sanity checks.

5.4 Requirements Not Supported in the V2 Delivery

Requirements from the GLAS Science Software Requirements Document that are not supported in the V2 delivery of the I-SIPS software are shown in Table 5-3.

Table 5-3 Requirements Not Supported

Requirements Number	Description	Status
GSDP-30100	The I-SIPS Software will create GLAS standard products that are to be delivered to the DAAC in the format agreed to by ESDIS.	original
GSDP-30204	GLA04 records shall span one second. The GLA04 is a multiframe product, containing individual files for the LRS, LPA, Instrument Star Tracker, Gyro, GPS, Ball Star Trackers, and spacecraft attitude and position data. One granule of GLA04 shall contain the time span of the EDOS level 0 delivery. The precision will be maintained as that on the level 0 data.	derived
GSDP-30603	GLA04 shall be created when the PDS is made available by EDOS. Input spacecraft telemetry data shall include the Position, Rate, and Attitude Packet (PRAP), and the GPS packet.	derived
GSDP-30900	Metadata will include an assessment of the software performance.	original
GSDP-31100	The I-SIPS Software shall produce metadata describing the data products and their quality.	original
GSDP-31101	Each granule will have corresponding Metadata that will be delivered.	derived
GSDP-31300	Automatic or manual Quality Assurance (QA) is provided for each standard data product and ancillary file. Until QA is completed, the file shall be marked as invalidated. Upon successful completion of QA, the file shall be marked as validated.	original

Abbreviations & Acronyms

EOS	NASA Earth Observing System Mission Program
EOSDIS	Earth Observing System Data and Information System
GLAS	Geoscience Laser Altimeter System instrument or investigation
GSFC	NASA Goddard Space Flight Center at Greenbelt, Maryland
GSFC/WFF	NASA Goddard Space Flight Center/Wallops Flight Facility at Wallops Island, Virginia
ID	Identification
LASER	Light Amplification by Stimulated Emission of Radiation
LIDAR	Light Detection and Ranging
N/A	Not (/) Applicable
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
POD	Precision Orbit Determination
TBD	to be determined, to be done, or to be developed
UNIX	the operating system jointly developed by the AT&T Bell Laboratories and the University of California-Berkeley System Division

Glossary

aggregate	A collection, assemblage, or grouping of distinct data parts together to make a whole. It is generally used to indicate the grouping of GLAS data items, arrays, elements, and EOS parameters into a data record. For example, the collection of Level 1B EOS Data Parameters gathered to form a one-second Level 1B data record. It could be used to represent groupings of various GLAS data entities such as data items aggregated as an array, data items and arrays aggregated into a GLAS Data Element, GLAS Data Elements aggregated as an EOS Data Parameter, or EOS Data Parameters aggregated into a Data Product record.
array	An ordered arrangement of homogenous data items that may either be synchronous or asynchronous. An array of data items usually implies the ability to access individual data items or members of the array by an index. An array of GLAS data items might represent the three coordinates of a georeference location, a collection of values at a rate, or a collection of values describing an altimeter waveform.
file	A collection of data stored as records and terminated by a physical or logical end-of-file (EOF) marker. The term usually applies to the collection within a storage device or storage media such as a disk file or a tape file. Loosely employed it is used to indicate a collection of GLAS data records without a standard label. For the Level 1A Data Product, the file would constitute the collection of one-second Level 1A data records generated in the SDPS working storage for a single pass.
header	A text and/or binary label or information record, record set, or block, prefacing a data record, record set, or a file. A header usually contains identifying or descriptive information, and may sometimes be embedded within a record rather than attached as a prefix.
item	Specifically, a data item. A discrete, non-decomposable unit of data, usually a single word or value in a data record, or a single value from a data array. The representation of a single GLAS data value within a data array or a GLAS Data Element.
label	The text and/or binary information records, record set, block, header, or headers prefacing a data file or linked to a data file sufficient to form a labeled data product. A standard label may imply a standard data product. A label may consist of a single header as well as multiple headers and markers depending on the defining authority.
Level 0	The level designation applied to an EOS data product that consists of raw instrument data, recorded at the original resolution, in time order, with any duplicate or redundant data packets removed.
Level 1A	The level designation applied to an EOS data product that consists of reconstructed, unprocessed Level 0 instrument data, recorded at the full resolution with time referenced data records, in time order. The data are annotated with ancillary information including radiometric and geometric calibration coefficients, and georeferencing parameter data (i.e., ephemeris data). The included, computed coefficients and parameter data have not however been applied to correct the Level 0 instrument data contents.

Level 1B	The level designation applied to an EOS data product that consists of Level 1A data that have been radiometrically corrected, processed from raw data into sensor data units, and have been geolocated according to applied georeferencing data.
Level 2	The level designation applied to an EOS data product that consists of derived geophysical data values, recorded at the same resolution, time order, and georeference location as the Level 1A or Level 1B data.
Level 3	The level designation applied to an EOS data product that consists of geophysical data values derived from Level 1 or Level 2 data, recorded at a temporally or spatially resampled resolution.
Level 4	The level designation applied to an EOS data product that consists of data from modeled output or resultant analysis of lower level data that are not directly derived by the GLAS instrument and supplemental sensors.
metadata	The textual information supplied as supplemental, descriptive information to a data product. It may consist of fixed or variable length records of ASCII data describing files, records, parameters, elements, items, formats, etc., that may serve as catalog, data base, keyword/value, header, or label data. This data may be parsable and searchable by some tool or utility program.
orbit	The passage of time and spacecraft travel signifying a complete journey around a celestial or terrestrial body. For GLAS and the EOS ALT-L spacecraft each orbit starts at the time when the spacecraft is on the equator traveling toward the North Pole, continues through the equator crossing as the spacecraft ground track moves toward the South Pole, and terminates when the spacecraft has reached the equator moving northward from the South Polar region.
module	A collection of program statements with four basic attributes: input and output, function, mechanics and internal data.
pass	A sub-segment of an orbit, it may consist of the ascending or descending portion of an orbit (e.g., a descending pass would consist of the ground track segment beginning with the northernmost point of travel through the following southernmost point of travel), or the segment above or below the equator; for GLAS the pass is identified as either the northern or southern hemisphere portion of the ground track on any orbit
product	Specifically, the Data Product or the EOS Data Product. This is implicitly the labeled data product or the data product as produced by software on the SDPS or SCF. A GLAS data product refers to the data file or record collection either prefaced with a product label or standard formatted data label or linked to a product label or standard formatted data label file. Loosely used, it may indicate a single pass file aggregation, or the entire set of product files contained in a data repository.
program	The smallest set of computer instructions that can be executed as a stand-alone unit
record	A specific organization or aggregate of data items. It represents the collection of EOS Data Parameters within a given time interval, such as a one-second data record. It is the first level decomposition of a product file.
Scenario	A single execution path for a process.

Standard Data Product	Specifically, a GLAS Standard Data Product. It represents an EOS ALT-L/ GLAS Data Product produced on the EOSDIS SDPS for GLAS data product generation or within the GLAS Science Computing Facility using EOS science community approved algorithms. It is routinely produced and is intended to be archived in the EOSDIS data repository for EOS user community-wide access and retrieval.
Subroutine	A program that is called by another program
variable	Usually a reference in a computer program to a storage location, i.e., a place to contain or hold the value of a data item.

